Bonneville Power Administration
Fish and Wildlife Program FY99 Proposal Form

Section 1. General administrative information

Impact of exotic fishes and macrophytes on juvenile salmonids rearing in littoral areas of the John Day Reservoir

Bonneville project number, if an ongoing project 9081

Business name of agency, institution or organization requesting funding
US Geological Survey, Biological Resources Division, Columbia River Research Laboratory

Business acronym (if appropriate) USGS-BRD

Proposal contact person or principal investigator:

Name	Dena Gadomski, Craig Barfoot, Thomas Poe
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Subcontractors.

Organization	Mailing Address	City, ST Zip	Contact Name
none			

NPPC Program Measure Number(s) which this project addresses.

2.2A Support and rebuild native species in native habitats.
5. The BPA should investigate the use of nearshore and shallow habitat by juvenile salmon in the John Day Reservoir.
5.7 Reduce predation and competition

5.7A Reduce numbers and curtail recruitment of non-native fish.
5.7B.15 Monitor populations of non-indigenous species as part of the program that monitors reservoir fish populations and communities....

NMFS Biological Opinion Number(s) which this project addresses.

13 h. The BPA shall investigate the effects of the intensified competition for food resulting from the introduction of non-native species.
14. The BPA shall continue studies of predator control.

Other planning document references.

Subbasin.

Lower mid-Columbia River mainstem subbasin

Short description.

Investigate habitat use by exotic fishes in littoral areas of the John Day Reservoir, Columbia River (particularly in backwaters), and possible impacts such as predation on juvenile salmonids. Examine the role of exotic and invasive vegetation in fish community structure.

Section 2. Key words

Mark	Programmatic Categories	Mark	Activities	Mark	Project Types
*	Anadromous fish		Construction		Watershed
X	Resident fish		O & M		Biodiversity/genetics
	Wildlife		Production	*	Population dynamics
	Oceans/estuaries	X	Research	X	Ecosystems
	Climate	*	Monitoring/eval.		Flow/survival
*	Other		Resource mgmt		Fish disease
			Planning/admin.		Supplementation
			Enforcement		Wildlife habitat en-
			Acquisitions		hancement/restoration

Other keywords.

exotic species, macrophytes, backwaters, habitat use, predation, competition

Section 3. Relationships to other Bonneville projects

Project #	Project title/description	Nature of relationship
none		

Section 4. Objectives, tasks and schedules

Objectives and tasks

Obj 1,2,3	Objective	Task a,b,c	Task
1	Determine aquatic plant species composition and site characteristics of vegetated habitats in the John Day Reservoir.	a	Collect and preserve representative samples of aquatic macrophyte species for later identification and verification.
		b	Measure depth and substrate composition as habitat indicators for aquatic macrophyte occurrence.
2	Quantify fish community composition in selected near-shore habitats of John Day Reservoir.	a	Sample fishes in a range of vegetated and non-vegetated shallow littoral habitats (stratified by depth and substrate type).
3	Determine if vegetated habitats are used by juvenile salmonids.	a	Examine differences in habitat use between habitat types (vegetated or non-vegetated).
		b	Determine differences in physicochemical characteristics (e.g., DO,Temp.)
4	Identify interactions between exotic fishes and juvenile salmonids in vegetated and non-vegetated habitats.	a	Determine, through dietary information, if there is differential predation on juvenile salmonids among vegetated and non-vegetated habitats.

Objective schedules and costs

Objective #	Start Date mm/yyyy	End Date mm/yyyy	Cost %
1	10/1998	09/2000	25%
2	10/1998	09/2000	25%
3	10/1998	09/2000	25%
4	10/1998	09/2001	25%

Schedule constraints.

High-flow years may result in limited shoreline sites with adequate aquatic vegetation growth for sampling, requiring an additional year of field work.

Completion date.

2001

Section 5. Budget

FY99 budget by line item

Item	Note	FY99
Personnel	GS-12 6 mths, GS-9 12 mths, GS-5 12 mths	$82,362
Fringe benefits	30%	24,709
Supplies, materials, non-expendable property	Laboratory & field supplies	6,000
Operations & maintenance	Boat, vehicle, gear O&M	9,768
Capital acquisitions or improvements (e.g. land, buildings, major equip.)		
PIT tags	# of tags:	
Travel	Field work per diem	7,200
Indirect costs		49,415
Subcontracts		
Other		
TOTAL		$179,454

Outyear costs

Outyear costs	FY2000	FY01	FY02	FY03
Total budget	$184,838	$150,000		
O&M as % of total	5%	5%		

Section 6. Abstract

The proliferation of exotic and invasive fishes and aquatic vegetation in littoral zones of impounded segments of the Columbia River Basin has likely substantially modified the ecology of shoreline areas. However, no research is currently being conducted to monitor exotic species in this area, although this is an objective of the FWP. Our goal is to determine the impact of exotic fishes and macrophytes on juvenile salmonid survival in near-shore and backwater reservoir habitats. Specifically, we will examine how macrophytes influence local habitat conditions, fish community composition, habitat use by juvenile salmonids, and predation on juvenile salmonids by introduced predators. Fishes will be sampled in main-channel and backwater vegetated and non-vegetated habitats of the John Day Reservoir using light traps for larvae, and boat electroshocking for juveniles and adults. Aquatic plant species composition and habitat characteristics will be determined at fixed sample sites. Gut samples will be obtained from exotic predators, and the intensity of predation on juvenile salmonids in different habitat types

will be determined. Information from this study will aid effective management of exotic species to maximize juvenile salmonid survival. Additionally, there has been much recent discussion concerning a return of the Columbia River to a more normal Ariverine≅ state through various changes in hydrosytem operation. Monitoring exotic species is a means of determining the success of attempts to return the Columbia River to a healthy river ecosystem with a greater proportion of native taxa.

Section 7. Project description

a. Technical and/or scientific background.

The transformation of the Columbia River from a riverine environment into a series of low-velocity impoundments by dams has in many areas resulted in altered habitat more suitable for exotic or invasive fishes and plants than most native species (Gadomski and Barfoot In press; Poe et al. 1994; Li et al. 1987). The proliferation of exotic or invasive fishes and aquatic vegetation in littoral areas of Columbia River reservoirs may be acting in concert to alter the suitability of shallow-water rearing habitat for juvenile chinook salmon *Oncorhynchus tshawytscha*. Some backwaters in particular have extensive areas covered by aquatic vegetation and support fish communities dominated by introduced taxa. These areas have previously been identified as important feeding and rearing habitats for juvenile salmonids (Zimmerman and Rasmussen 1981; Parente and Smith 1980). Many exotic fish species now abundant in impounded areas of the Columbia River (e.g., ictalurids, centrarchids, and percids) are also directly dependent on vegetated low-velocity (Kilgore et al. 1989) habitats for spawning, rearing, and feeding. A number of these introduced species may directly prey upon or compete with juvenile salmonids (Poe et al. 1994; Li et al. 1987).

Low-velocity main-channel shoreline and backwater areas appear to have undergone relatively recent post-impoundment habitat changes. Backwater studies conducted in the John Day Reservoir during the 1970s and early 1980s (Zimmerman and Rasmussen 1981; Parente and Smith 1980) did not note the presence of watermilfoil *Myriophyllum* spp., although it is now well established in many shallow-water areas of the Columbia River. Such changes can have profound influences on the ecology of these habitats. Aquatic vegetation can play a central role in the trophic dynamics of shallow habitats by influencing prey availability, water circulation patterns, DO, pH, and the temperature of surrounding areas (Carter et al. 1991). Macrophyte beds also create structurally complex habitats, possibly contributing to increased abundance and distribution of associated exotic fish species. These changes could effect habitat use by juvenile salmonids and potential interactions (e.g., predation and competition) between juvenile salmonids and other taxa.

Predation on juvenile salmonids has been well documented in main-channel habitats of the John Day Reservoir (Poe et al. 1991; Reiman et al. 1991; Vigg et al. 1991). Although these studies identified northern squawfish as the most important predator on juvenile salmonids, introduced taxa such as smallmouth bass and channel catfish

consume considerable numbers of juvenile salmonids in some situations (Tabor et al. 1993; Poe et al. 1994). Little current information, however, is available for localized habitats such as backwaters where fish communities may be dominated by exotic taxa, although these areas are frequently used by juveniles of several salmonid species (Zimmerman and Rasmussen 1981). Much of the previous research identifying the seasonal importance of backwater habitats to juvenile salmonids may have been conducted prior to the proliferation of aquatic vegetation in these areas. The possible use of aquatic macrophytes by juvenile salmonids for rearing and feeding habitats has not been investigated. We propose to describe the abundance and distribution of fishes associated with vegetated and non-vegetated habitats in selected areas of the John Day Reservoir, and to describe the importance of juvenile salmonids in the diets of predators in these habitats. We are using the John Day Reservoir as our study location because linking results from the proposed study with previous work (BPA Project 90-078) may allow us to extrapolate and explore relationships on a larger scale through spatial modeling. This could lead to greater predictive capabilities and allow managers to "visualize" potential changes in abiotic and biotic interactions in the John Day Reservoir prior to possible future changes in system operations.

This work is directly applicable to 1994 Fish and Wildlife Program (FWP) objectives to 1) 5.7B.15. Monitor populations of non-indigenous species; 2) 2.2A.Support and rebuild native species; 3) 5.7 A. Reduce numbers and curtail recruitment of non-native fishes, and 4) 5.0 investigate the use of near-shore and shallow habitat by juvenile salmon in the John Day Reservoir. To attain these objectives, basic knowledge of the abundance and distribution of exotic species is essential, in addition to possible overlaps with juvenile salmonid distributions in shoreline areas.

Key project personnel have extensive experience relevant to the proposed project. Dena Gadomski and Craig Barfoot have conducted research on larval and juvenile fishes in limnetic and littoral areas of the Columbia River for the past five years (1993-1997; BPA Project 90078), resulting in the following manuscripts: Gadomski and Barfoot (In press), Barfoot et al. (In review), Barfoot (In preparation), Gadomski et al. (In preparation). Thomas Poe and Dena Gadomski have studied predation on juvenile salmonids in the Columbia River Basin resulting in the following manuscripts: Poe et al. 1991, Vigg et al. 1991, Gadomski and Hall Griswold (1992), Gadomski et al. (1994), Petersen and Gadomski (1994), Petersen et al. (1994), and Poe et al. (1994). Additionally, James Petersen of the Columbia River Research Laboratory has extensive experience in modeling predator-prey and population dynamics and will act as a technical advisor.

b. Proposal objectives.

Our goal is to determine the effect of exotic fishes and macrophytes on juvenile salmonid survival in near-shore and backwater reservoir habitats. Specifically, we will examine how macrophytes influence local habitat conditions, fish community composition, habitat use by juvenile salmonids, and predation on juvenile salmonids by

introduced predators. Results of the study will be summarized in reports, presentations at scientific meetings, and in peer-reviewed publications.

Objective 1. Determine aquatic plant species composition and site characteristics of vegetated habitats in the John Day Reservoir and the effects of aquatic macrophytes on surrounding physicochemical conditions.

(H_o) Bottom and surface water quality parameters (e.g., temperature, DO) do not differ between vegetated and non-vegetated habitats.

Objective 2. Quantify fish community composition in selected vegetated and non-vegetated main-channel and backwater shallow-water habitats of the John Day Reservoir.

(H_o) Fish community composition does not differ between vegetated and non-vegetated shallow-water habitats.

Objective 3. Determine use of vegetated habitats by juvenile salmonids.

(H_o) There is no difference in numbers of juvenile salmonids sampled in vegetated and non-vegetated sites.

Objective 4. Determine levels of predation on juvenile salmonids in vegetated and non-vegetated littoral habitats.

(H_o) Location (main-channel or backwater) and habitat type (vegetated or non-vegetated) have no effect on numbers of juvenile salmonids in the diets of predators.

c. Rationale and significance to Regional Programs.

Objectives of the FWP are to support and rebuild native species in native habitats, investigate the use of nearshore and shallow habitat use by juvenile salmon in the John Day Reservoir, reduce predation and competition, reduce numbers and curtail recruitment of non-native fish, and monitor populations of non-indigenous species (see Section 1). Some of these objectives have been addressed in predation studies and juvenile chinook habitat studies by the USGS-BRD, ODFW, and WDFW. However, no research is currently being conducted on exotic species in the Columbia River Basin, although it is generally agreed that this is an important issue. In particular, in order to effectively manage exotic species, it is important to determine which interactions between exotic species and juvenile salmonids might affect salmonid survival. Additionally, there has been much recent discussion concerning a return of the Columbia River to a more normal Ariverine≅ state through various changes in hydrosytem operation. Monitoring exotic species is a means of determining the success of attempts to return the Columbia River to a healthy river ecosystem with a greater proportion of native taxa.

d. Project history

e. Methods.

Objective 1. Determine aquatic plant species composition and site characteristics of vegetated habitats in the John Day Reservoir. Determine the effect of aquatic macrophytes on surrounding physicochemical conditions.

Task 1.1. Main-channel and backwater locations will be surveyed in early spring to determine vegetated and non-vegetated fixed sampling sites at comparable depths over similar substrate types. Substrate composition will be determined with a ponar dredge.

Task 1.2. Voucher plant specimens from all vegetated sample sites will be collected and curated for later identification and, if necessary, verification by a plant taxonomist.

Task 1.3. Surface (upper 0.5 m) and bottom water quality parameters will be measured weekly during early morning (dawn) and afternoon at randomly-selected sample sites among previously identified vegetated and non-vegetated habitats. Water quality parameters to be measured include dissolved oxygen, temperature, and turbidity.

Objective 2. Quantify fish community composition in selected vegetated and non-vegetated main-channel and backwater shallow-water habitats of the John Day Reservoir.

Task 2.1. Fish communities will be sampled in all classes of habitat types (main-channel and backwater vegetated and non-vegetated) with two gear types. Larval fishes will be collected during nighttime using light traps. Light trap samples will be preserved in 10% formalin and returned to the laboratory for processing and identification. Juvenile and adult fishes will be sampled from approximately 90 min. before sunrise (Tabor et al. 1993) until early morning with boat-mounted electrofishing gear. We will use a repeated an analysis of variance (depending on the distribution of the data) to determine the influence of habitat location and type (main-channel, backwater, vegetated or nonvegetated) on the abundance of fish collected (numbers or CPUE of fish of each species collected per shocking run or light trap set). Fish communities will also be compared among the habitat types sampled using a community similarity index.

Objective 3. Determine use of vegetated habitat by juvenile salmonids.

Task 3.1. Numbers of juvenile salmonids collected per shocking run will be used as a measure of abundance (CPUE if runs are of unequal duration) between vegetated and non-vegetated sites. To determine if juvenile salmonids are associated with or not associated with vegetated habitats in greater numbers than expected, we will use a statistical measure of comparison (chi-square analysis) and a non-statistical electivity index based on numbers of salmonids sampled in each habitat type.

Objective 4. Determine predation on juvenile salmonids in vegetated and non-vegetated littoral habitats.

Task 4.1. Stomach contents (stomachs will be pumped or fish will be sacrificed depending on species) from captured fishes considered to be potential predators will be examined for the presence of juvenile salmonids using techniques in Hansel et al. (1988), Poe et al. (1991), and Petersen et al. (1990).

f. Facilities and equipment.

Field work will be conducted using gear acquired for BPA Project 90078, which includes a 19 ft aluminum electroshocking boat with a 90 hp outboard. Laboratory work (identification of preserved larval and juvenile fishes, gut analysis) will be conducted at the USGS Columbia River Research Laboratory (CRRL), Cook, Washington. Dissecting microscopes (Leica Wild M3 Z) with 8-40X zoom magnification are available at the CRRL for use in examining specimens.

g. References. Relevant manuscripts authored by the principal investigators.

Barfoot, Craig A., Dena M. Gadomski, & Robert H. Wertheimer. In review. Growth and mortality of age-0 northern squawfish Ptychocheilus oregonensis during early rearing in shoreline habitats of a Columbia River Reservoir, U.S.A. Environmental Biology of Fishes.

Barfoot, Craig A. In preparation. Changes in near-shore fish community composition in a lower Columbia River impoundment.

Gadomski, Dena M. & Craig A. Barfoot. In press. Diel and distributional abundance patterns of fish embryos and larvae in the lower Columbia and Deschutes rivers. Environmental Biology of Fishes.

Gadomski, Dena M., Craig A. Barfoot, Jennifer M. Bayer, & Thomas P. Poe. In preparation. Early life history of the northern squawfish Ptychocheilus oregonensis in the lower Columbia River and two tributaries.

Gadomski, D.M., and J.A. Hall-Griswold. 1992. Predation by northern squawfish on live and dead juvenile chinook salmon. Transactions of the American Fisheries Society. 121: 680-685.

Gadomski, D.M., M.G. Mesa, and T.M. Olson. 1994. Vulnerability to predation and physiological stress responses of experimentally descaled juvenile chinook salmon, Oncorhynchus tshawytscha. Environmental Biology of Fishes. 39: 191-199.

Mesa, M.G., T.P. Poe, D.M. Gadomski, and J.H. Petersen. 1994. Are all prey created equal? A review and synthesis of differential predation on prey in substandard condition.

Journal of Fish Biology. 45: 81-96.

Petersen, J.H., and D.M. Gadomski. 1994. Light-mediated predation by northern squawfish on juvenile chinook salmon. Journal of Fish Biology. 45: 227-242.

Petersen, J.H., D.M. Gadomski, and T.P. Poe. 1994. Differential predation by northern squawfish (Ptychocheilus oregonensis) on live and dead juvenile salmonids in the Bonneville Dam tailrace (Columbia River). Canadian Journal of Fisheries and Aquatic Sciences. 51: 1197-1204.

Poe, T. P., H. C. Hansel, S. Vigg, D. E. Palmer, and L. A. Prendergast. 1991. Feeding of predaceous fishes on out-migrating juvenile salmonids in John Day Reservoir, Columbia River. Transactions of the American Fisheries Society 120: 405-420.

Poe, T. P., R. S. Shively, and R. A. Tabor. 1994. Ecological consequences of introduced piscivorous fishes in the lower Columbia and Snake rivers. Pages 347-360, in D. J. Stouder, K. Fresh, and R. J. Feller (eds.), Theory and Application in Fish Feeding Ecology. Bell W. Baruch Library and Marine Sciences, No. 18, University of South Carolina Press, Columbia, South Carolina.

Other References

Carter, V., N. B. Rybicki, and R. Hammerschlag. 1991. Effects of submersed macrophytes on dissolved oxygen, pH, and temperature under different conditions of wind, tide, and bed structure. Journal of Freshwater Ecology 6:121-133.

Hansel, H.C., S.D. Duke, P.T. Lofy, and G.A. Gray. 1988. Use of diagnostic bones to identify and estimate original lengths of ingested prey fishes. Transactions of the American Fisheries Society 117:55-62.

Kilgore, K. J., R. P. Morgan II, and N. B. Rybicki. 1989. Distribution and abundance of fishes associated with submersed aquatic plants in the Potomac River. North American Journal of Fisheries Management 9: 101-111.

Li, H. W., C. B. Schreck, C. E. Bond, and E. Rexstad. 1987. Factors influencing changes in stream fish assemblages of Pacific Northwest streams, In W. J. Matthews and D. C. Heins (eds.), Community and Evolutionary Ecology of North American Stream Fishes. University of Oklahoma Press: Norman, Oklahoma, and London.

Parente, W. D., and J. G. Smith. 1981. Columbia River backwater study. Phase II. Final Report by the Fisheries Assistance Office. U. S. Fish and Wildlife Service, Vancouver, Washington.

Petersen, J. H., M. G. Mesa, J. Hall-Griswold, W. C. Schrader, G. W. Short, and T. P. Poe. 1990. Magnitude and dynamics of predation on juvenile salmonids in Columbia and Snake River reservoirs. Annual Report 1989. Bonneville Power Administration,

Portland, Oregon.

Rieman, B. E., R. C. Beamesderfer, S. Vigg, and T. P. Poe. 1991. Estimated loss of juvenile salmonids to predation by northern squawfish, walleyes, and smallmouth bass in John Day Reservoir, Columbia River. Transactions of the American Fisheries Society 120: 448-458.

Tabor, R. A., R. S. Shively, and T. P. Poe. 1993. Predation of juvenile salmonids by smallmouth bass and northern squawfish in the Columbia River near Richland, Washington. North American Journal of Fisheries Management 13: 831-838.

Vigg, S., T. P. Poe, L. A. Prendergast, and H. C. Hansel. 1991. Rates of consumption of juvenile salmonids and alternative prey fish by northern squawfish, walleyes, smallmouth bass, and channel catfish in John Day Reservoir, Columbia River. Transactions of the American Fisheries Society 120: 421-438.

Zimmerman, M. A., and L. A. Rasmussen. 1981. Juvenile salmonid use of three backwater areas proposed for subimpoundment. U. S. Fish and Wildlife Service-Ecological Services. Portland, Oregon.

Section 8. Relationships to other projects

Objectives of the FWP are to support and rebuild native species in native habitats, investigate the use of nearshore and shallow habitat by juvenile salmon in the John Day Reservoir, reduce predation and competition, reduce numbers and curtail recruitment of non-native fish, and monitor populations of non-indigenous species (see Section 1). Some of these objectives have been addressed in predation studies and juvenile chinook salmon habitat studies by the USGS-BRD, ODFW, and WDFW. However, no research is currently being conducted to monitor exotic species in the Columbia River Basin, although it is generally agreed this is an important issue. In particular, in order to effectively manage exotic species, it is important to determine which interactions between exotic species and juvenile salmonids might affect salmonid survival. Additionally, there has been much recent interest in returning the Columbia River to a more normal Ariverine≅ state; monitoring exotic species is a means of determining the success of attempts to return the Columbia River to a healthy river ecosystem with a greater proportion of native taxa.

Section 9. Key personnel

Key project personnel have extensive experience relevant to the proposed project. Dena Gadomski (Principal investigator: Research Fishery Biologist GS-12; FTE 0.5) and Craig Barfoot (Project manager: Research Fishery Biologist GS-9; FTE 1.0) have conducted research on larval and juvenile fishes in limnetic and littoral areas of the

Columbia River for the past five years (1993-1997; BPA Project 90078), resulting in the following manuscripts: Gadomski and Barfoot (In press), Barfoot et al. (In review), Barfoot (In preparation), Gadomski et al. (In preparation). Additionally, Thomas Poe (Project leader: Supervisory Fishery Biologist GM-13) and Dena Gadomski have studied predation on juvenile salmonids in the Columbia River Basin resulting in the following manuscripts: Poe et al. 1991, Vigg et al. 1991, Gadomski and Hall Griswold (1992), Gadomski et al. (1994), Petersen and Gadomski (1994), Petersen et al. (1994), and Poe et al. (1994). Additionally, James Petersen (Research Fishery Biologist GS-13) of the Columbia River Research Laboratory will act as technical advisor. He has extensive experience in modeling predator-prey and population dynamics.

Dena M. Gadomski, Principal Investigator
Research Fishery Biologist

School	Degree	Date
University of California, Berkeley	B.A. Biology	1976
Oregon State University, College of Oceanography	M.S. Biological Oceanography	1983

Current Employer: U.S. Geological Survey - Biological Resources Division, Columbia River Research Laboratory, Cook, Washington

Current Responsibilities: Currently I supervise a research study with the large-scale goal of examining the abundance and distribution of larval and juvenile fishes in the Columbia River Basin. The focus of this study is to understand the basic early life history of the northern squawfish Ptychocheilus oregonensis, a dominant predator of juvenile salmonids in this area.

Recent Previous Employment: Project Manager/Fisheries Scientist. Occidental College, VANTUNA Research Group, Los Angeles, CA, 1985-1989.

Expertise: Larval and juvenile fish ecology. Predator-prey interactions.

Recent Relevant Publications:

Gadomski, D.M., and C.A. Barfoot. In press. Diel and distributional abundance patterns of fish embryos and larvae in the lower Columbia and Deschutes rivers. Environmental Biology of Fishes.

Gadomski, D.M., M.G. Mesa, and T.M. Olson. 1994. Vulnerability to predation and physiological stress responses of experimentally descaled juvenile chinook salmon, Oncorhynchus tshawytscha. Environmental Biology of Fishes. 39: 191-199.

Mesa, M.G., T.P. Poe, D.M. Gadomski, and J.H. Petersen. 1994. Are all prey created equal? A review and synthesis of differential predation on prey in substandard condition. Journal of Fish Biology. 45: 81-96.

Petersen, J.H., and D.M. Gadomski. 1994. Light-mediated predation by northern squawfish on juvenile chinook salmon. Journal of Fish Biology. 45: 227-242.

Gadomski, D.M., and J.A. Hall-Griswold. 1992. Predation by northern squawfish on live and dead juvenile chinook salmon. Transactions of the American Fisheries Society. 121: 680-685.

Craig A. Barfoot, Project Manager
Research Fishery Biologist

School	Degree	Date
University of South Dakota	B.S. Biology	1989
Montana State University	M.S. Fish and Wildlife Management	1993

Current Employer: U.S. Geological Survey - Biological Resources Division, Columbia River Research Laboratory, Cook, Washington

Current Responsibilities: Currently I am a team leader for a project studying possible effects of lower Snake River drawdown on predation-related juvenile salmonid mortality. I am also involved in research examining the abundance and distribution of larval and juvenile fishes in the Columbia River Basin.

Recent Previous Employment: Research Assistant. Biology Department, Montana State University, Bozeman, MT, 1990-1992.

Expertise: Fish assemblage structure. Fish habitat requirements. Larval and juvenile fish ecology.

Recent Relevant Manuscripts:

Barfoot, C.A. In preparation. Changes in near-shore fish community composition in a lower Columbia River impoundment.

Barfoot, C. A., D.M. Gadomski, and R. H. Wertheimer. In review. Growth and mortality of age-0 northern squawfish Ptychocheilus oregonensis during early rearing in shoreline habitats of a Columbia River Reservoir, U.S.A. Environmental Biology of Fishes.

Gadomski, D. M., and C. A. Barfoot. In press. Diel and distributional abundance patterns of fish embryos and larvae in the lower Columbia and Deschutes rivers. Environmental Biology of Fishes.

Barfoot, C.A., D.M. Gadomski, A.M. Murphy, and G.T. Schultz. 1994. Reproduction and early life history of northern squawfish Ptychocheilus oregonensis in the Columbia River. pp. 7-40 In Gadomski, D.M. and Poe, T.P. (eds.), System-wide significance of predation. Annual report by the National Biological Survey to the Bonneville Power Administration, Portland, OR.

Barfoot, C.A. 1993. Longitudinal distribution of fishes and habitat in Little Beaver Creek, MT. M.S. Thesis. Fish and Wildlife Management, Montana State University, Bozeman, MT.

Thomas P. Poe, Project Leader
Supervisory Fishery Biologist

School	Degree	Date
Carroll College	B.S. Biology	1966
Northern Illinois University	M.S. Zoology	1972

Current Employer: U.S. Geological Survey - Biological Resources Division
Columbia River Research Laboratory, Cook, Washington

Current Responsibilities: I serve as project leader for several fisheries research projects in the lower Columbia River. Studies focus on: (1) juvenile salmonid passage behavior at John Day, The Dalles, and Bonneville dams, (2) habitat use by larval and juvenile anadromous and resident fishes in lower Columbia River reservoirs, and (3) a graduate student research project comparing pre and post-impoundment river features in upper John Day Reservoir using a GIS to manipulate and analyze spatial and biological data.

Recent Previous Employment: Supervisory Fishery Biologist/Project Leader, U.S. Geological Survey, Biological Resources Division, Great Lakes Research Center, Ann Arbor, Michigan, 1979-1986.

Expertise: Applied behavioral ecology of fishes, specializing in predator-prey interactions, and on early life history studies, particularly focused on spawning and rearing habitat requirements .

Recent Relevant Publications:

Poe, T.P., R.S. Shively, and R.A.Tabor. 1994. Ecological consequences of introduced piscivorous fishes in the lower Columbia and Snake rivers. Pages 347-360, in D.J. Stouder, K. Fresh, and R.J. Feller (eds.), Theory and Application in Fish Feeding Ecology. Bell W. Baruch Library and Marine Sciences, No. 18, University of South Carolina Press, Columbia, South Carolina.

Poe, T.P., H.C. Hansel, S. Vigg, D.E. Palmer, and L. A. Prendergast. 1991. Feeding of predaceous fishes on out-migrating juvenile salmonids in John Day Reservoir, Columbia River. Transactions of the American Fisheries Society 120: 405-420.

Vigg, S., T. P. Poe, L. A. Prendergast, and H. C. Hansel. 1991. Rates of consumption of juvenile salmonids and alternative prey fish by northern squawfish, walleyes, smallmouth bass, and channel catfish in John Day Reservoir, Columbia River. Transactions of the American Fisheries Society 120: 421-438.

James H. Petersen, Technical Advisor

Experience

1995-Present	Research Fishery Biologist, U.S. Geological Survey, Biological Resources Division, Columbia River Research Laboratory, Cook, WA. Current responsibilities: Project leader on research project to determine survival of summer steelhead over their first winter in the Wind River Basin (WA). Co-leader on various mainstem Columbia and Snake River projects concerning juvenile salmon passage, predation, and reservoir drawdown.
1994	Acting Director, Columbia River Research Laboratory, USGS, Cook, WA.
1988-93	Research Fishery Biologist, Columbia River Research Laboratory, U.S. Fish and Wildlife Service.
1984-88	Associate Research Curator, Section of Fishes, Natural History Museum of Los Angeles County, Los Angeles, CA.
1983-84	Environmental Scientist, Section of Fishes, Natural History Museum of Los Angeles County.
1977-83	Graduate Teaching Assistant, University of Oregon, Eugene, OR.

Education: Degree or training, School, and Date Received

Ph. D., Marine Ecology, University of Oregon, 1983
Rotary Fellowship, University of Queensland, Australia, 1976
B. S., Biology, Boise State University, Idaho, 1975

Expertise: Primary areas of expertise include predator-prey dynamics, population dynamics, and application of various modeling techniques to fisheries.

Publications and Reports (five most relevant)

Petersen, J. H., and D. L. DeAngelis. 1992. Functional response and capture timing in an individual-based model: predation by northern squawfish (*Ptychocheilus oregonensis*) on juvenile salmonids in the Columbia River. Can. J. Fish. Aquat. Sci. 49:2551-2565.

Petersen, J. H. 1994. The importance of spatial pattern in estimating predation on juvenile salmonids in the Columbia River. Trans. Am. Fish. Soc. 123:924-930.

Petersen, J.H. and D.M. Gadomski. 1994. Light-mediated predation by northern squawfish on juvenile salmon. J. Fish Biol. 45: 227-242.

Ward, D. L., J. H. Petersen, and J. J. Loch. 1995. Index of predation on juvenile salmonids by northern squawfish in the lower and middle Columbia River and in the lower Snake River. Trans. Am. Fish. Soc. 124:321-334.

Petersen, J. H. and D. L. Ward. In review. Development and corroboration of a bioenergetics model for northern squawfish feeding on juvenile salmonids in the Columbia River. Trans. Am. Fish. Soc.

Section 10. Information/technology transfer

Results will be presented in reports, manuscripts for publication in peer-reviewed journals, and in presentations at scientific meetings.